(12) UK Patent Application (19) GB (11) 2 193 907 (13) A

(43) Application published 24 Feb 1988

(21) Application No 8615428

(22) Date of filing 24 Jun 1986

(51) INT CL⁴
B01J 32/00

(52) Domestic classification (Edition J):
B1F D1B
C1J 14 1 35 9 X

(56) Documents cited
GB A 2098083 GB 1468577 EP A1 0060622
GB 1557485 EP A1 0095851 EP A1 0052894

(58) Field of search
B1E
B1F
C1J
Selected US specifications from IPC sub-class B01J

(71) Applicant
Dyson Refractories Limited

(Incorporated in United Kingdom)

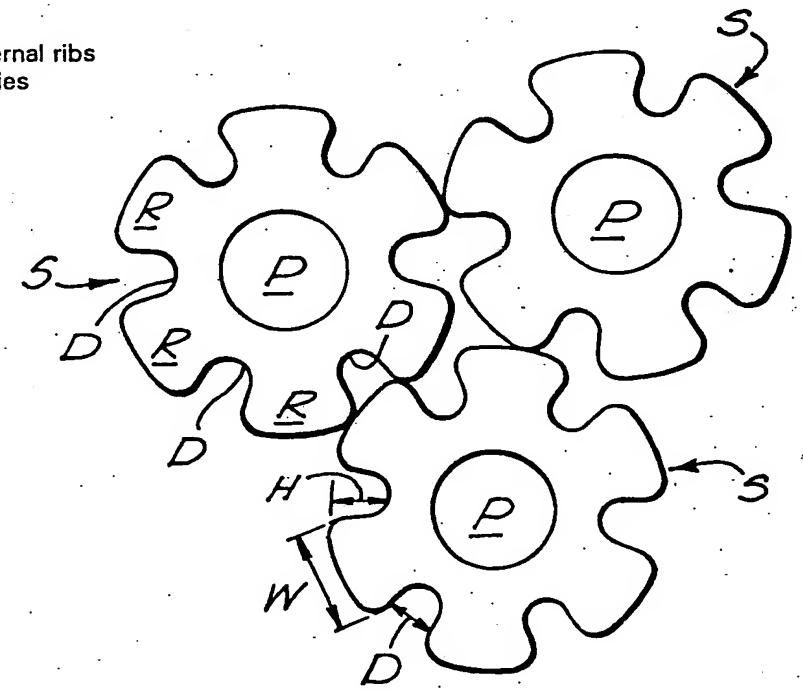
381 Fulwood Road, Sheffield S10 3GB

(72) Inventor
Rodney Martin Sambrook

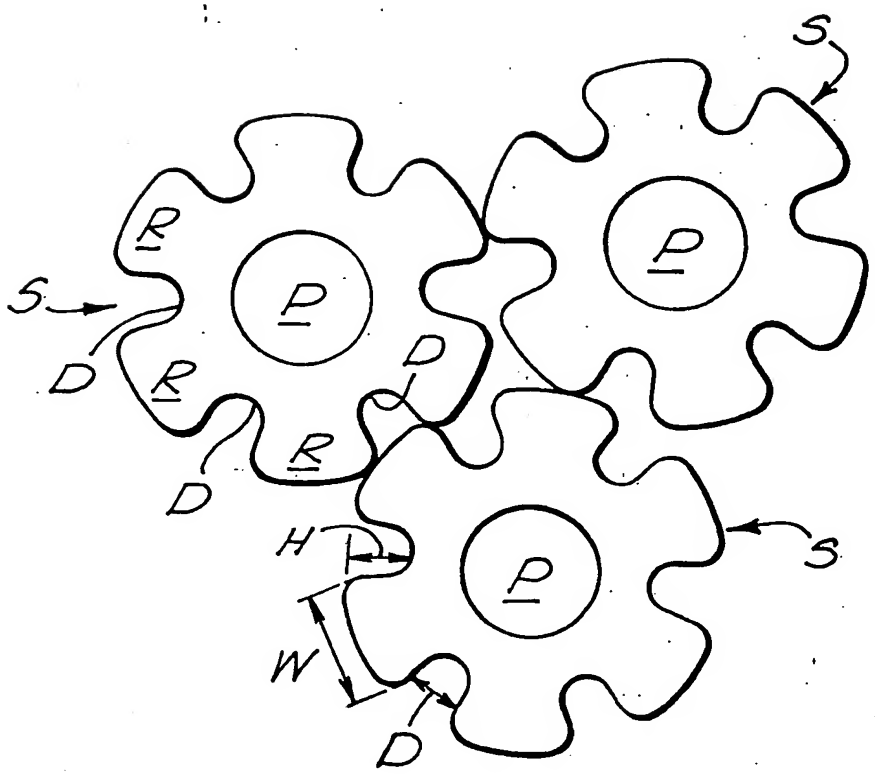
(74) Agent and/or Address for Service
Laurence Shaw,
George House, George Road, Edgbaston, Birmingham
B15 1PG

(54) Ribbed catalyst bodies

(57) A catalyst body has external ribs shaped so that adjacent bodies cannot interlock.



GB 2 193 907 A


S
R
P
S
D
R
D
R
D
H
W
P
S
D

SPECIFICATION

Ribbed catalyst bodies

The invention relates to catalyst bodies i.e. preformed catalyst carriers loaded with catalytically active material or a shaped mass of a catalytically active material, optionally with additives. The catalytically active material will usually be a metal e.g. nickel as in steam reforming or a metallic oxide such as vanadium pentoxide.

It is taught in U.S. patent 2408164 that catalyst bodies may be of different shapes e.g. cylinders, rings, discs and plates. It has also been realised that the shape of a carrier can influence the catalytic activity of the supported catalyst, and also the pressure drop which occurs across the catalyst bed. See for example U.S. patent 4402870 where the catalyst carrier has external longitudinally extending ribs.

It has now been realised that when such carriers are used, in particular in tubular reactors such as in the steam reforming of hydrocarbons or the production of ethylene oxide, adjacent carriers can link together to form a chain or bridge. This is a disadvantage as a random arrangement of the carriers is required for optimum catalytic activity and to prevent maldistribution of gas flow, e.g. channelling. In a packed bed reactor interlocking of the catalyst bodies will reduce void fraction of the reactor, decrease effective surface area and may increase pressure drop across the catalyst bed.

According to this invention, a catalyst body has a plurality of external ribs and is *characterised in that* the ribs are arranged such that the ribs of adjacent carriers cannot interlock.

Most preferably, the ribs are prevented from interlocking by the distance between adjacent ribs on each body. Preferaby the ribs are spaced apart by a distance between adjacent ribs which is smaller than the width of the ribs. In a particularly preferred feature, the distance apart is approximately half of the width.

The number of external ribs on the body may be varied. Preferably at least four ribs are present, and they are radially spaced about the body.

It is a preferred feature of the invention that the ribs are integrally formed with the body by extrusion. The body may be of cylindrical shape.

The body is typically a substantially chemically inert, catalytically inert, rigid refractory solid. In a much preferred feature of the invention the catalyst body comprises a refractory porous carrier which is a preformed low surface area ceramic matrix, the pores of which are loaded with particles of catalytically active material. Preferably the preformed low surface area ceramic matrix has an apparent porosity pore diameter in the range of 0.1 micron to 20 micron and a surface area of less than $10m^2g$. The preformed low surface area ceramic matrix may be alpha—alumina but other preformed low surface area matrices of ceramic materials such as silicon carbide, aluminosilicates, silica etc., may be used. By the use of this type of carrier the catalyst body has improved refractoriness and useful life.

The preformed low surface area ceramic matrix may be pretreated with acid or alkali to modify the interaction of the catalytically active material and the ceramic matrix. The surface of the ceramic matrix may also be modified by the addition of "spacer/support" material e.g. alumina within the pores of the ceramic matrix prior to introduction of the catalyst and may be accomplished by the simple impregnation of the ceramic matrix with a soluble salts of the "spacer/support" material, e.g. aluminium nitrate or by using a homogeneous precipitation technique. In each case the temperature of the calcination of the impregnated preformed low surface area ceramic matrix must be carefully controlled to achieve the required surface properties.

The catalyst active material may be introduced into the carrier in any convenient way. For example, the preformed ceramic matrix may be impregnated, under vacuum, with a solution containing nitrate salts of the metal components of the catalyst. After draining of excess solution from the outside of the carrier the ceramic matrix may be heated to a temperature suitable for the controlled decomposition of the nitrates e.g. 450°C. to the metallic oxides. Prior to use one or more of the metallic oxides may require reduction to the metal or to a lower oxidation.

The metal loading of the catalyst may be increased by repetition of the process steps.

In order that the invention may be well understood it will now be described by way of example with reference to the accompanying diagrammatic drawing, which shows a plurality of carriers.

Each carrier has six longitudinal external ribs R separated by lands D in between which measure about 5 mm. The preferred ratio of R:D is about 1.5:1 to about 5:1, preferably about 2:1. In one example the ribs measure about 5 mm high H and 9 mm wide W. As shown there are six such ribs but this number is not critical to the invention and the number (which may be even or odd) may be varied widely. The catalyst body also has a through passageway P. The carrier has a length L: diameter ratio of about 0.5 to about 2.5:1.

In use, the carrier S is located with others in a tubular catalyst reactor. Because the ribs are wider than the lands in between, no two carriers can interlock which ensures that they are located randomly, so giving a high catalytic activity, lower pressure drop and uniform

CLAIMS

1. A catalyst body, comprising a generally having a plurality of external ribs, *characterised in that* the ribs (R) are arranged such that the ribs of adjacent bodies (S) cannot interlock.

2. A body according to Claim 1 *characterised in that* the ribs (R) are spaced apart by a circumferential distance (D) between adjacent ribs (R) which is smaller than the width (W) of the ribs.

3. A body according to Claim 2 *characterised in that* the distance (D) is approximately half of the width (W).

4. A body according to any preceding Claim *characterised in that* at least four ribs (R) are present, and they are radially spaced about the body (S).

5. A body according to any preceding Claim *characterised in that* the support is a porous body impregnated by a catalyst in particulate form.

6. A body according to Claim 5 *characterised in that* the support is low surface area ceramic matrix.

7. A body according to Claim 5 or 6 *characterised in that* the body is formed of alpha alumina.

8. A body according to any Claim 5, 6 or 7 *characterised in that* it has been formed by extrusion.

9. A body according to any of Claims 1 to 4 *characterised in that* the body is a body shaped mass of catalystically active material.

10. A body according to any of Claims 5 to 8 *characterised in that* the catalyst comprises nickel.

11. A body for a catalyst, substantially as described.

12. A tubular reactor *characterised in that* by the presence of a catalyst body according to any preceding Claim.

Published 1988 at The Patent Office, State House, 66/71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office, Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Burgess & Son (Abingdon) Ltd. Con. 1/87.